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(71) Applicant: TOSHIBA CORP

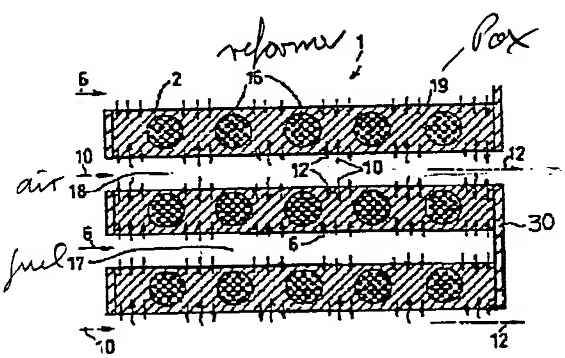
(72) Inventor: MURATA KEIJI
MUNEUCHI ATSUO

(54) REFORMING UNIT AND FUEL CELL USING THE SAME

(57) Abstract:

PROBLEM TO BE SOLVED: To solve a problem that conventionally the temperature of a catalyst for combustion elevates locally by an oxidation reaction caused by the mixing of a fuel gas and air, and as a result the life of the catalyst for combustion is short.

SOLUTION: This reforming unit 1 consists of a pile of a plurality of catalyst layers for combustion 19 consisting of a planar state porous material loaded with the catalyst for combustion. Between the adjacent catalyst layers for combustion 19, a fuel gas flow route 17 for flowing the fuel gas 6 and an air flow route 18 for flowing the air 10 are installed alternately. Also in the catalyst layers for combustion 19, a reforming tube 16 filled with a reforming catalyst such as nickel, platinum, etc., is installed. Also, at the one end of a pair of catalyst layers for combustion 19, a hermetically closing plate 30 so as not to leak the air 10 and the fuel gas 6, is installed. By such a constitution, a local temperature elevation caused by mixing and burning of the fuel gas 6 with the air 10, can be suppressed and an activity of the catalyst for combustion can be maintained for a long period of time.



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CLAIMS

[Claim(s)]
[Claim 1] It has the heat produced according to the chemical reaction of an oxidizer and fuel gas in the interior, and the reforming section which reforms reforming raw material gas and generates reforming gas is provided. The catalyst section for combustion among which an oxidizer and fuel gas can circulate, The reformer characterized by consisting of the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies fuel gas to the above-mentioned catalyst section for combustion, and circulating an oxidizer and fuel gas face to face by the above-mentioned catalyst circles for combustion.
[Claim 2] The catalyst section for combustion among which an oxidizer and fuel gas can circulate, and the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, It is arranged at the fuel gas circulation section which supplies fuel gas to the above-mentioned catalyst section for combustion, and the above-mentioned oxidizer circulation section. The reformer characterized by having the heat produced according to the chemical reaction of an oxidizer and fuel gas, consisting of the reforming section which reforms reforming raw material gas and generates reforming gas, and circulating an oxidizer and fuel gas face to face by the above-mentioned catalyst circles for combustion.
[Claim 3] It has the heat produced according to the chemical reaction of an oxidizer and fuel gas in the interior, and the reforming section which reforms reforming raw material gas and generates reforming gas is provided. The catalyst section for combustion among which an oxidizer and fuel gas can circulate, The reformer characterized by being formed in the above-mentioned catalyst circles for combustion, consisting of the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies fuel gas to the above-mentioned catalyst section for combustion, and circulating an oxidizer and fuel gas face to face by the above-mentioned catalyst circles for combustion.
[Claim 4] An oxidizer and fuel gas are a reformer the claim 1 characterized by being mixed through the above-mentioned catalyst section for combustion, 2, or given in three.
[Claim 5] the above-mentioned catalyst section for combustion of an adjoining couple -- at least -- an end -- bridge formation -- the reformer according to claim 1 characterized by constructing and sealing by the section
[Claim 6] The fuel tank in which fuel gas is stored, and the reforming raw material tank which stores reforming raw material gas, It has the heat produced according to the chemical reaction of an oxidizer and fuel gas in the interior, and the reforming section which reforms reforming raw material gas and is made into reforming gas is provided. The catalyst section for combustion among which an oxidizer and fuel gas can circulate, It consists of the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies the fuel gas supplied to the above-mentioned catalyst section for combustion from the above-mentioned fuel tank. by the above-mentioned catalyst circles for combustion The fuel cell characterized by consisting of a reformer which it counters [reformer] and circulates an oxidizer and fuel gas, and the electromotive section which generates the electrical and electric equipment by the reforming gas discharged from the above-mentioned reformer flowing in, and carrying out the chemical reaction of this reforming gas under predetermined temperature.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention heats the gas (reforming raw material gas) which started the fuel cell which used a reformer and it, especially mixed the steam in hydrocarbon gas, and relates to the fuel cell using the reformer and it which are reformed in the gas (reforming gas) which makes hydrogen a principal component using a catalyst.
[0002]
[Description of the Prior Art] According to electrochemical reaction, a fuel cell is a power plant which changes chemical energy into direct electrical energy, and attracts attention as an efficient and clean energy source. Moreover, there is a reformer as an element which constitutes a fuel cell. A reformer reforms the reforming raw material gas containing a hydrocarbon, and is generating the reforming gas which makes hydrogen a principal component. The generated reforming gas is supplied to the electromotive section which is an element which constitutes a fuel cell, and is contributed to power generation.
[0003] Below, it is attached to the configuration of the fuel cell which used the conventional reformer and it, and explains with reference to drawing 6 and 7. Drawing 7 is an outline block diagram of a fuel cell. In the principal part of a fuel cell, it is fuel gas 6 (solid line in a view). Air 10 (solid line in a view) Reforming raw material gas 13 (view destructive line) Reforming gas 14 (view destructive line) reformed by the reformer 1 supplied and the reformer 1 It consists of a fuel cell mainframe 15 supplied.
[0004] Drawing 8 is sectional drawing of the distributed propellant plate type reformer of a reformer. As for a reformer 1, it comes to carry out the laminating of the reforming room 3, the combustion chamber 5, and the fuel-supply room 7. Here, the reforming room 3 and the combustion chamber 5 are divided, and the combustion chamber 5 and the fuel-supply room 7 are divided by the propellant distributor 9 by the heat transfer septum 8. The hole 11 of a plurality [distributor / propellant / 9] is drilled.
[0005] The reforming room 3 is filled up with the globular form catalyst for reforming 2. A combustion chamber 5 is filled up with the globular form catalyst for combustion 4. It attaches and explains to an operation of the reformer which carried out such a configuration.
[0006] After the preheater not to illustrate preheats the air 10 which is fuel gas 6 and an oxidizer, it is supplied to the fuel-supply room 7 and the combustion chamber 5, respectively. The fuel gas 6 supplied to the fuel-supply room 7 passes two or more holes 11 drilled in the propellant distributor 9, and flows into a combustion chamber 5. It is mixed with air 10, and burns and the fuel gas 6 which flowed in is a combustion gas 12 (solid line in drawing). It becomes and is discharged from a combustion chamber 5.
[0007] On the other hand, after the preheater not to illustrate preheats hydrocarbon gas 13, for example, the reforming raw material gas which mixed the steam in methane, it is supplied to the reforming room 3. The reforming raw material gas 13 supplied all over the reforming room 3 is changed into the reforming gas 14 which is heated by the propellant heat which occurred in the combustion chamber 5, and makes hydrogen a principal component, circulating between the adjoining catalysts for reforming 2. The changed reforming gas 14 is discharged by the reforming room 3 exteriors. The reforming gas 14 discharged from the reforming room 3 is sent to the fuel cell mainframe 15 through a heat exchanger, a carbon-monoxide-conversion machine, etc. not to illustrate, and is generated according to a chemical reaction.
[0008]

[Problem(s) to be Solved by the Invention] However, although fuel gas is distributed and supplied to a combustion chamber in the conventional reformer which carried out the above configurations, since fuel gas and air are mixed in a combustion chamber at the time of supply, the scaling reaction by the catalyst starts. A vapor-phase-oxidation reaction arises and, simultaneously with the reaction, the temperature of combustion gas rises locally more than desired temperature. Therefore, the degradation of the catalyst for combustion progressed and there was a problem that the life of the catalyst for combustion fell remarkably.

[0009] Then, this invention was made in view of the above-mentioned conventional trouble, suppresses a vapor-phase-oxidation reaction, carries out occurrence of a catalyst scaling reaction to stability, prevents that the temperature of the catalyst for combustion becomes out of a desired temperature area, and aims at offer of the reformer which can maintain the activity of the catalyst for combustion for a long period of time.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the reformer of this invention It has the heat produced according to the chemical reaction of an oxidizer and fuel gas in the interior, and the reforming section which reforms reforming raw material gas and generates reforming gas is provided. The catalyst section for combustion among which an oxidizer and fuel gas can circulate, It consists of the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies fuel gas to the above-mentioned catalyst section for combustion, is the above-mentioned catalyst circles for combustion, and is the configuration of circulating an oxidizer and fuel gas face to face.

[0011] Next, the catalyst section for combustion among which, as for the reformer of this invention, an oxidizer and fuel gas can circulate, The oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies fuel gas to the above-mentioned catalyst section for combustion, It is arranged at the above-mentioned oxidizer circulation section, it has the heat produced according to the chemical reaction of an oxidizer and fuel gas, consists of the reforming section which reforms reforming raw material gas and generates reforming gas, is the above-mentioned catalyst circles for combustion, and is the configuration of circulating an oxidizer and fuel gas face to face.

[0012] The reformer of this invention has the heat produced according to the chemical reaction of an oxidizer and fuel gas in the interior, and the reforming section which reforms reforming raw material gas and generates reforming gas is provided. Next, the catalyst section for combustion among which an oxidizer and fuel gas can circulate, It is formed in the above-mentioned catalyst circles for combustion, consists of the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies fuel gas to the above-mentioned catalyst section for combustion, is the above-mentioned catalyst circles for combustion, and is the configuration of circulating an oxidizer and fuel gas face to face.

[0013] Next, the fuel tank in which the fuel cell of this invention stores fuel gas and the reforming raw material tank which stores reforming raw material gas, It has the heat produced according to the chemical reaction of an oxidizer and fuel gas in the interior, and the reforming section which reforms reforming raw material gas and is made into reforming gas is provided. The catalyst section for combustion among which an oxidizer and fuel gas can circulate, It consists of the oxidizer circulation section which supplies an oxidizer to the above-mentioned catalyst section for combustion, and the fuel gas circulation section which supplies the fuel gas supplied to the above-mentioned catalyst section for combustion from the above-mentioned fuel tank. by the above-mentioned catalyst circles for combustion The reforming gas discharged from the reformer which it counters [reformer] and circulates an oxidizer and fuel gas, and the above-mentioned reformer flows in, and it consists of the electromotive section which generates the electrical and electric equipment by carrying out the chemical reaction of this reforming gas under predetermined temperature. Moreover, the control unit and two or more heat exchangers which control the service conditions which change a chemical reaction into the electrical and electric equipment, such as flow rates, such as a power converter, temperature, and fuel gas, are prepared in a fuel cell.

[0014]

[Embodiments of the Invention] Hereafter, the example of this invention is explained, referring to a drawing. Drawing 1 is sectional drawing of the 1st example of a reformer. It comes to carry out two or more laminatings of the catalyst layer for combustion 19 (catalyst section for combustion) which a reformer 1 becomes from the flat-surface-like porous material field with which it filled up with the catalyst for combustion. Between the adjoining catalyst layers for combustion 19, the airstream way (oxidizer circulation section) 18 where the fuel gas passage (fuel gas circulation section) 17 where fuel gas 6 circulates, and air (oxidizer) 10 circulate is formed by turns. Moreover, in the catalyst layer for combustion 19, the reforming spool (reforming section) 16 with which it filled up with the catalysts for reforming 2, such as nickel and platinum, is formed. Moreover, the sealing plate (bridge formation section) 30 is constructed by the end of the catalyst layer for combustion 19 of a couple so that neither air 10 nor fuel gas 6 may leak.

[0015] It attaches and explains to an operation of the 1st example of a reformer which consists of such a configuration. The combustion gas 6 supplied from the fuel tank not to illustrate passes along the fuel gas passage 17, and it flows in, being spread in the catalyst layer for combustion 19. Moreover, the air 10 supplied from the air receiver not to illustrate passes along the airstream way 18, and it flows in, being spread in the catalyst layer for combustion 19. the orientation where the fuel gas 6 which flowed in, and air 10 flow into the catalyst layer for combustion 19 -- mutual -- the opposite orientation (orientation which counters) it is -- a sake -- the inside of the catalyst layer for combustion 19 -- mixing . The position which fuel gas 6 and air 10 mix is in the distance which can diffuse the oxygen contained to air 10. Air 10 and fuel gas 6 are oxidation reaction (complete-oxidation reaction) by mixture. It starts and is combustion (diffusion catalyzed combustion). It carries out. The combustion gas 12 generated by combustion passes along the airstream way 18, and is discharged out of a reformer 1 with the air 10 which was not used for combustion.

[0016] Moreover, the heat which occurs by the diffusion catalyzed combustion travels to the reforming spool 16, and reforms the reforming raw material gas which circulates the inside of the reforming spool 16. In the 1st example of a reformer which was described above, fuel gas 6 is distributed and supplied to the catalyst layer for combustion 19, and it is a position in the catalyst layer for combustion 19 (position which the oxygen of the amount of stoichiometries in air diffuses within the catalyst layer for combustion 19). Since fuel gas 6 and air 10 are mixed, a vapor-phase-oxidation reaction is suppressed. Therefore, it does not go up locally more than the temperature of a request of the temperature of combustion gas 6. Therefore, the activity of the catalyst layer for combustion 19 is maintainable for a long period of time.

[0017] Moreover, since air 10 and fuel gas 6 react within the catalyst layer for combustion 19, the combustion generated by mixing air 10 and fuel gas 6 directly can be suppressed, and a desired chemical reaction can be generated. By generating a desired chemical reaction, the temperature of the catalyst layer for combustion 19 does not rise more than predetermined temperature, but it can be used for a long period of time, without the catalyst layer for combustion 19 deteriorating.

[0018] Moreover, when a diffusion catalyzed combustion occurs within the catalyst layer for combustion 19, the heat by the chemical reaction serves as a heat source required for the reforming of reforming raw material gas, and the reforming reaction is promoted. An adjunctive heat source simultaneously, required in order to generate reforming gas from reforming raw material gas is not needed, but it contributes to a cost reduction and a miniaturization.

[0019] Furthermore, since the reforming spool 16 is formed in the catalyst layer for combustion, the heat-conducting characteristic of the heat which occurs by the diffusion catalyzed combustion is good. Next, it is attached to the configuration of the 2nd example of the reformer of this invention, and explains with reference to drawing 2 .

[0020] In addition, in each following example, the same component as the 1st example attaches the same sign, and the overlapping explanation is omitted. The characteristic feature of the 2nd example is that the reforming spool 16 was formed in the airstream way 18, and is the reforming spool's 16 being heated and promoting a reforming reaction by the convection current of the radiant heat from the catalyst layer for combustion 19, and the combustion gas 12 discharged from the catalyst layer for combustion 19.

[0021] Drawing 2 is sectional drawing of the 2nd example of a reformer. A cross section is arranged in the airstream way 18 where the reforming spool 16 of a circle configuration was formed between the adjoining catalyst layers for combustion 19.

[0022] The reforming spool 16 is formed in the orientation which intersects perpendicularly

within the flat surface of the catalyst layer for combustion 19 to the orientation where air 10 flows. It attaches and explains to an operation of the 2nd example of a reformer which consists of such a configuration.

[0023] It passes through the airstream way 18 and air 10 is the flat surface (they are one of fields among the fields where the catalyst layer for combustion 19 goes direct to the orientation by which a laminating is carried out) of the catalyst layer for combustion 19. It is supplied from one side. Moreover, fuel gas 6 passes along the fuel gas passage 17, and is supplied from another side of the flat surface of the catalyst layer for combustion 19. The flow direction within the catalyst layer for combustion 19 of air 10 and fuel gas 6 is reverse, and has countered. stable [cause / air 10 and fuel gas 6 are the positions which air 10 and fuel gas 6 mix, and / oxidation reaction and] -- a diffusion catalyzed combustion is carried out

[0024] The combustion gas 12 after combustion passes along the airstream way 18, and is discharged by the reformer 1 exterior. Moreover, the reforming spool 16 is heated by heat transfer by the convection current of the combustion gas 12 discharged from the catalyst layer for combustion 19, and the radiant heat from the catalyst layer for combustion 19. The reforming raw material gas which circulates the inside of the reforming spool 16 causes a reforming reaction with these heat, and turns into reforming gas.

[0025] In the 2nd example of a reformer which was described above, fuel gas 6 is distributed and supplied to the catalyst layer for combustion 19, and it is a position in the catalyst layer for combustion 19 (position which the oxygen of the amount of stoichiometries in air diffuses within the catalyst layer for combustion 19). Since fuel gas 6 and air 10 are mixed, a vapor-phase-oxidation reaction is suppressed. Therefore, it does not go up locally more than the temperature of a request of the temperature of combustion gas 6. Therefore, the activity of the catalyst layer for combustion 19 is maintainable for a long period of time.

[0026] Moreover, since air 10 and fuel gas 6 react within the catalyst layer for combustion 19, the combustion generated by mixing air 10 and fuel gas 6 directly can be suppressed, and a desired chemical reaction can be generated. By generating a desired chemical reaction, the temperature of the catalyst layer for combustion 19 does not rise more than predetermined temperature, but it can be used for a long period of time, without the catalyst layer for combustion 19 deteriorating.

[0027] Moreover, when a diffusion catalyzed combustion occurs within the catalyst layer for combustion 19, the heat by the chemical reaction serves as an adjunctive heat source required for the reforming of reforming raw material gas, and the reforming reaction is promoted. A heat source simultaneously, required in order to generate reforming gas from reforming raw material gas is not needed, but it contributes to a cost reduction and a miniaturization.

[0028] Furthermore, when generating electricity by carrying out the rate of flow of the reforming raw material gas which circulates the inside of the reforming spool 16 early, by using heat transfer by the convection current of the radiant heat from the catalyst layer for combustion 19, or the propellant exhaust gas 12 which is an elevated temperature comparatively, a reforming reaction can be promoted and a generating efficiency can be gathered.

[0029] Moreover, in order not to form the reforming spool 16 into the catalyst layer for combustion 19, the manufacture is simple and it contributes to a cost reduction. Next, it is attached to the configuration of the 3rd example of the reformer of this invention, and explains with reference to drawing 3 .

[0030] The characteristic feature of the 3rd example is having been filled up with the catalyst for reforming 2 in the reforming room 3 of a field configuration, having carried out opposite arrangement of the reforming room 3 through the airstream way 10 to the catalyst layer for combustion 19, and having promoted the reforming reaction.

[0031] Drawing 3 is sectional drawing of the 3rd example of a reformer. To the catalyst layer for combustion 19, through the airstream way 18, the reforming room (reforming section) 3 of a field configuration counters, and is arranged. It fills up with the catalyst for reforming 2 in the reforming room 3.

[0032] It attaches and explains to an operation of the 3rd example of a reformer which consists of such a configuration. The air 10 and the fuel gas 6 which are mixed within the catalyst layer for combustion 19 cause oxidation reaction, and stabilized for it and carry out a diffusion catalyzed combustion. The combustion gas 12 generated by combustion passes along the airstream way 18, and is discharged by the reformer 1 exterior with the air 10 which did not burn.

[0033] Moreover, reforming raw material gas 13 is supplied to the reforming room 3, and is

reformed. The reformed reforming gas 14 is discharged by the reforming room 3 exteriors. Heat required in order that the reforming reaction at this time may happen is based on a radiant heat from heat transfer by the convection current of a combustion gas 12, or the catalyst layer for combustion 19.

[0034] In the 3rd example of a reformer which was described above, fuel gas 6 is distributed and supplied to the catalyst layer for combustion 19, and it is a position in the catalyst layer for combustion 19 (position which the oxygen of the amount of stoichiometries in air diffuses within the catalyst layer for combustion 19). Since fuel gas 6 and air 10 are mixed, a vapor-phase-oxidation reaction is suppressed. Therefore, it does not go up locally more than the temperature of a request of the temperature of combustion gas 6. Therefore, the activity of the catalyst layer for combustion 19 is maintainable for a long period of time.

[0035] Moreover, since air 10 and fuel gas 6 react within the catalyst layer for combustion 19, the combustion generated by mixing air 10 and fuel gas 6 directly can be suppressed, and a desired chemical reaction can be generated. By generating a desired chemical reaction, the temperature of the catalyst layer for combustion 19 does not rise more than predetermined temperature, but it can be used for a long period of time, without the catalyst layer for combustion 19 deteriorating.

[0036] Moreover, when a diffusion catalyzed combustion occurs within the catalyst layer for combustion 19, the heat by the chemical reaction serves as a heat source required for the reforming of reforming raw material gas, and the reforming reaction is promoted. An adjunctive heat source simultaneously, required in order to generate reforming gas from reforming raw material gas is not needed, but it contributes to a cost reduction and a miniaturization.

[0037] Furthermore, when generating electricity by carrying out the rate of flow of the reforming raw material gas 13 which circulates the inside of the reforming room 3 early, and generating reforming gas 14, by using heat transfer by the convection current of the radiant heat from the catalyst layer for combustion 19, or the propellant exhaust gas 12 which is an elevated temperature comparatively, a reforming reaction can be promoted and a generating efficiency can be gathered.

[0038] Moreover, when reforming reforming raw material gas 13 so much simultaneously, it can process by using the reforming room 3 of a field configuration. Moreover, since the reforming room 3 is a field configuration, the manufacture is easy and an assembly also becomes easy.

[0039] Next, it is attached to the configuration of the 4th example of the reformer of this invention, and explains with reference to drawing 4 . The characteristic feature of the 4th example is that the air 10 supplied to the catalyst layer for combustion 19 is directly supplied through the air pipe 20 formed in the catalyst layer for combustion 19, and made efficient the diffusion catalyzed combustion of air 10 and fuel gas 6.

[0040] Drawing 4 is sectional drawing of the 4th example of a reformer. A cross section lays underground or implants in the inside of the catalyst layer for combustion 19, or its front face the air pipe 20 which carried out the circle configuration. A part of periphery of an air pipe 20 is cut so that air 10 can flow out.

[0041] It attaches and explains to an operation of the 4th example of a reformer which consists of such a configuration. Air 10 is directly supplied to the catalyst layer for combustion from an air pipe 20. Fuel gas 6 passes along the fuel gas passage 17, and is supplied to the catalyst layer for combustion. Fuel gas 6 and air 10 are air 10 (specifically oxygen of the amount of stoichiometries) in the catalyst layer for combustion. It mixes in the position diffused theoretically and the diffusion catalyzed combustion occurred and stabilized in the complete-oxidation reaction is started.

[0042] The combustion gas 12 after combustion passes the catalyst layer for combustion, and flows out out of the catalyst layer for combustion. Then, it is discharged by the reformer 1 exterior through the combustion-gas passage 21. In the 4th example of a reformer which was described above, fuel gas 6 is distributed and supplied to the catalyst layer for combustion 19, and it is a position in the catalyst layer for combustion 19 (position which the oxygen of the amount of stoichiometries in air diffuses within the catalyst layer for combustion 19). Since fuel gas 6 and air 10 are mixed, a vapor-phase-oxidation reaction is suppressed. Therefore, it does not go up locally more than the temperature of a request of the temperature of combustion gas 6. Therefore, the activity of the catalyst layer for combustion 19 is maintainable for a long period of time.

[0043] Moreover, since air 10 and fuel gas 6 react within the catalyst layer for combustion 19, the combustion generated by mixing air 10 and fuel gas 6 directly can be suppressed, and a desired

chemical reaction can be generated. By generating a desired chemical reaction, the temperature of the catalyst layer for combustion 19 does not rise more than predetermined temperature, but it can be used for a long period of time, without the catalyst layer for combustion 19 deteriorating.
[0044] Moreover, when a diffusion catalyzed combustion occurs within the catalyst layer for combustion 19, the heat by the chemical reaction serves as a heat source required for the reforming of reforming raw material gas, and can promote a reforming reaction. An adjunctive heat source simultaneously, required in order to generate reforming gas from reforming raw material gas is not needed, but it contributes to a cost reduction and a miniaturization.
[0045] Furthermore, since air 10 is compulsorily supplied in the catalyst layer for direct combustion 19, being discharged out of a reformer 1 with a combustion gas 12, while it has been unreacted is lost. Therefore, while the air 10 supplied burns efficiently, combustion efficiency improves and the calorific value per unit volume increases, it becomes unnecessary to supply the air 10 more than a desired amount, and a cost reduction can be attained.
[0046] Furthermore, since the reforming spool 16 is formed in the catalyst layer for combustion, the heat-conducting characteristic of the heat which occurs by the diffusion catalyzed combustion is good. Next, it is attached to the configuration of the 5th example of the reformer of this invention, and explains with reference to <u>drawing 5</u> .
[0047] The characteristic feature of the 5th example is having formed the air pipe 20 in the catalyst layer for combustion, and having arranged the reforming room 3 through the combustion-gas passage 21 to the catalyst layer for combustion, having made efficient the diffusion catalyzed combustion of air 10 and fuel gas 6, and having promoted the reforming reaction.
[0048] <u>Drawing 5</u> is sectional drawing of the 5th example of a reformer. A cross section lays underground or implants in the front face of the catalyst layer for combustion the air pipe 20 which carried out the circle configuration. As for a part of periphery of an air pipe 20, the part is cut so that air 10 can flow out in the catalyst layer for combustion. Moreover, the reforming room 3 of a field configuration is arranged through the combustion-gas passage 21 to the catalyst layer for combustion. The interior of the reforming room 3 is filled up with the catalyst for reforming 2.

[0049] It attaches and explains to an operation of the 5th example of a reformer which consists of such a configuration. Air 10 is directly supplied to the catalyst layer for combustion from an air pipe 20. Fuel gas 6 passes along the fuel gas passage 17, and is supplied to the catalyst layer for combustion. Fuel gas 6 and air 10 are air 10 (specifically oxygen of the amount of stoichiometries) in the catalyst layer for combustion. It mixes in the position diffused theoretically and the diffusion catalyzed combustion occurred and stabilized in the complete-oxidation reaction is started. The combustion gas 12 after combustion passes the catalyst layer for combustion, and flows out out of the catalyst layer for combustion. Then, it is discharged by the reformer 1 exterior through the combustion-gas passage 21.
[0050] Moreover, reforming raw material gas 13 is reformed in the process which is supplied to the reforming room 3 and circulates the reforming room 3. The reformed reforming gas 14 is discharged by the reforming room 3 exteriors. Heat required in order that the reforming reaction at this time may happen is based on a radiant heat from heat transfer to the reforming room 3 by the convection current of a combustion gas 12, or the catalyst layer for combustion 19.
[0051] In the 5th example of a reformer which was described above, fuel gas 6 is distributed and supplied to the catalyst layer for combustion 19, and it is a position in the catalyst layer for combustion 19 (position which the oxygen of the amount of stoichiometries in air diffuses within the catalyst layer for combustion 19). Since fuel gas 6 and air 10 are mixed, a vapor-phase-oxidation reaction is suppressed. Therefore, it does not go up locally more than the temperature of a request of the temperature of combustion gas 6. Therefore, the activity of the catalyst layer for combustion 19 is maintainable for a long period of time.
[0052] Moreover, since air 10 and fuel gas 6 react within the catalyst layer for combustion 19, the combustion generated by mixing air 10 and fuel gas 6 directly can be suppressed, and a desired chemical reaction can be generated. By generating a desired chemical reaction, the temperature of the catalyst layer for combustion 19 does not rise more than predetermined temperature, but it can be used for a long period of time, without the catalyst layer for combustion 19 deteriorating.
[0053] Moreover, when a diffusion catalyzed combustion occurs within the catalyst layer for combustion 19, the heat by the chemical reaction serves as a heat source required for the reforming of reforming raw material gas, and can promote a reforming reaction. An adjunctive

heat source simultaneou[illegible] required in order to generate reformi[illegible]as from reforming raw material gas is not needed, but it contributes to a cost reduction and a miniaturization.

[0054] Furthermore, since air 10 is supplied in the catalyst layer for direct combustion, being discharged out of a reformer 1 with a combustion gas 12, while it has been unreacted is lost. Therefore, while the air 10 supplied is used efficiently, it becomes unnecessary to supply the air 10 more than a desired amount, and a cost reduction can be attained.

[0055] Furthermore, when generating electricity by carrying out the rate of flow of the reforming raw material gas 13 which circulates the inside of the reforming room 3 early, and generating reforming gas 14, by using heat transfer by the convection current of the radiant heat from the catalyst layer for combustion 19, or the propellant exhaust gas 12 which is an elevated temperature comparatively, a reforming reaction can be promoted and a generating efficiency can be gathered.

[0056] Moreover, when reforming reforming raw material gas 13 so much simultaneously, it can process by using the reforming room 3 of a field configuration. Moreover, since the reforming room 3 is a field configuration, the manufacture is easy and an assembly also becomes easy. Furthermore, since the air 10 supplied is compulsorily supplied to the catalyst layer for combustion 19, it burns efficiently within the catalyst layer for combustion 19, combustion efficiency improves, and the calorific value per unit volume increases.

[0057] Next, it is attached to the configuration of the 1st example of the fuel cell of this invention, and explains with reference to drawing 6 . Drawing 6 is sectional drawing of the 1st example of a fuel cell.

[0058] Piping connects with a reformer 1 and the fuel tank 31 in which fuel gas 6 is stored, and the reforming raw material tank 32 which stores reforming raw material gas 13 are formed. It comes to carry out two or more laminatings of the catalyst layer for combustion 19 which a reformer 1 becomes from the flat-surface-like porous material field with which it filled up with the catalyst for combustion. Between the adjoining catalyst layers for combustion 19, the airstream way 18 where the fuel gas passage 17 where fuel gas 6 circulates, and air 10 circulate is formed by turns. Moreover, in the catalyst layer for combustion 19, the reforming spool with which it filled up with the catalysts for reforming, such as nickel and platinum, is formed. Moreover, a sealing plate is constructed by the end of the catalyst layer for combustion 19 of a couple so that neither air 10 nor fuel gas 6 may leak.

[0059] The reforming gas 14 discharged from a reformer 1 flows into the electromotive section 33 connected to a reformer 1. It attaches and explains to an operation of the 1st example of the fuel cell which consists of such a configuration.

[0060] The combustion gas 6 supplied from the fuel tank 31 passes along the fuel gas passage 17, and it flows in, being spread in the catalyst layer for combustion 19. Moreover, the air 10 supplied from the air receiver not to illustrate passes along the airstream way 18, and it flows in, being spread in the catalyst layer for combustion 19. the orientation where the fuel gas 6 which flowed in, and air 10 flow into the catalyst layer for combustion 19 -- mutual -- the opposite orientation (orientation which counters) it is -- a sake -- the inside of the catalyst layer for combustion 19 -- mixing . The position which fuel gas 6 and air 10 mix is the distance which can diffuse the oxygen contained to air 10. Air 10 and fuel gas 6 are oxidation reaction (complete-oxidation reaction) by mixture. It starts and is combustion (diffusion catalyzed combustion). It carries out. The combustion gas 12 generated by combustion passes along the airstream way 18, and is discharged out of a reformer 1 with the air 10 which was not used for combustion.

[0061] Moreover, the heat which occurs by the diffusion catalyzed combustion travels to the reforming spool 16, and reforms the reforming raw material gas 13 which circulates the inside of the reforming spool 16. The reformed reforming gas 14 is sent to the electromotive section 33. In the electromotive section 33, by carrying out the chemical reaction of the reforming gas 14 at predetermined temperature, the electrical and electric equipment is generated and it has taken out.

[0062] In the 1st example of a fuel cell which was described above, fuel gas 6 is distributed and supplied to the catalyst layer for combustion 19, and it is a position in the catalyst layer for combustion 19 (position which the oxygen of the amount of stoichiometries in air diffuses within the catalyst layer for combustion 19). Since fuel gas 6 and air 10 are mixed, a vapor-phase-oxidation reaction is suppressed. Therefore, it does not go up locally more than the temperature of a request of the temperature of combustion gas 6. Therefore, the activity of the catalyst layer for combustion 19 is maintainable for a long period of time.

[0063] Moreover, since air 10 and fuel gas 6 react within the catalyst layer for combustion 19, the combustion generated by mixing air 10 and fuel gas 6 directly can be suppressed, and a desired chemical reaction can be generated. By generating a desired chemical reaction, the temperature of the catalyst layer for combustion 19 does not rise more than predetermined temperature, but it can be used for a long period of time, without the catalyst layer for combustion 19 deteriorating.
[0064] Moreover, when a diffusion catalyzed combustion occurs within the catalyst layer for combustion 19, the heat by the chemical reaction serves as a heat source required for the reforming of reforming raw material gas, and the reforming reaction is promoted. An adjunctive heat source simultaneously, required in order to generate reforming gas from reforming raw material gas is not needed, but it contributes to a cost reduction and a miniaturization.
[0065] Furthermore, since the reforming spool is formed in the catalyst layer for combustion, the heat-conducting characteristic of the heat which occurs by the diffusion catalyzed combustion is good. Moreover, since a reformer 1 serves as a longevity life, the fuel cell itself is stabilized for a long period of time, and it can be operated.
[0066] In addition, it cannot be overemphasized that it deforms variously and can carry out in the domain which this invention is not limited to the above-mentioned example, and does not deviate from the main point. for example, an air pipe -- the shape of a tubular type -- not but -- ** -- what configuration is sufficient as long as air circulates at least
[0067]
[Effect of the Invention] As explained above, the local temperature rise which is generated by mixing fuel gas and air and burning according to this invention can be suppressed, and the activity of the catalyst for combustion can be maintained for a long period of time.

[Translation done.]

* NOTICES *

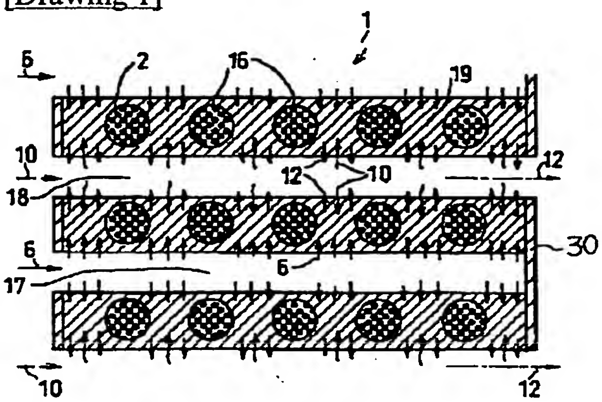
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Sectional drawing of the 1st example of the reformer of this invention
[Drawing 2] Sectional drawing of the 2nd example of the reformer of this invention
[Drawing 3] Sectional drawing of the 3rd example of the reformer of this invention
[Drawing 4] Sectional drawing of the 4th example of the reformer of this invention
[Drawing 5] Sectional drawing of the 5th example of the reformer of this invention
[Drawing 6] Sectional drawing of the 1st example of the fuel cell of this invention
[Drawing 7] The outline block diagram of the conventional fuel cell
[Drawing 8] Sectional drawing of the distributed propellant plate type reformer of the conventional reformer
[Description of Notations]
1 Reformer
2 Catalyst for Reforming
3 Reforming Room (Reforming Section)
4 Catalyst for Combustion
5 Combustion Chamber
6 Fuel Gas
7 Fuel-Supply Room
8 Heat Transfer Septum
9 Propellant Distributor
10 Air
11 Hole
12 Combustion Gas
13 Reforming Raw Material Gas
14 Reforming Gas
15 Fuel Cell Mainframe
16 Reforming Spool (Reforming Section)
17 Fuel Gas Passage (Fuel Gas Circulation Section)
18 Airstream Way (Oxidizer Circulation Section)
19 Catalyst Layer for Combustion (Catalyst Section for Combustion)
20 Air Pipe
21 Combustion-Gas Passage
30 Sealing Plate (Bridge Formation Section)
31 Fuel Tank
32 Reforming Raw Material Tank
33 Electromotive Section

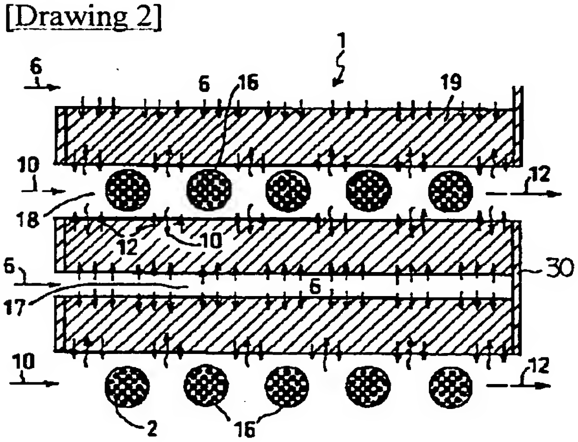
[Translation done.]

DRAWINGS

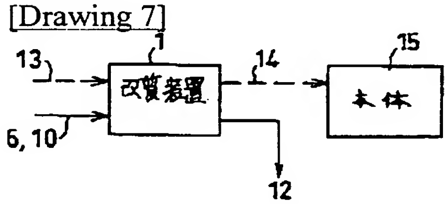
[Drawing 1]



[Drawing 2]



[Drawing 7]



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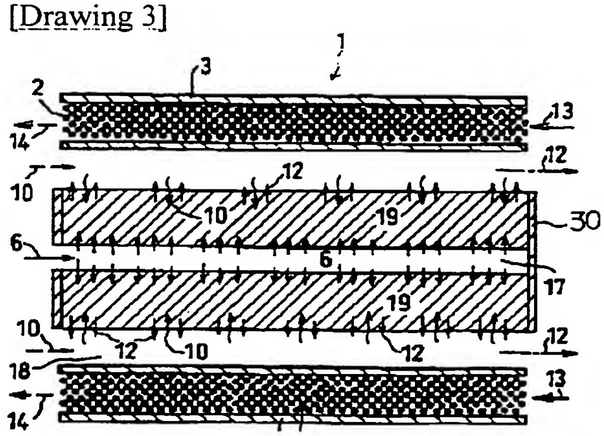

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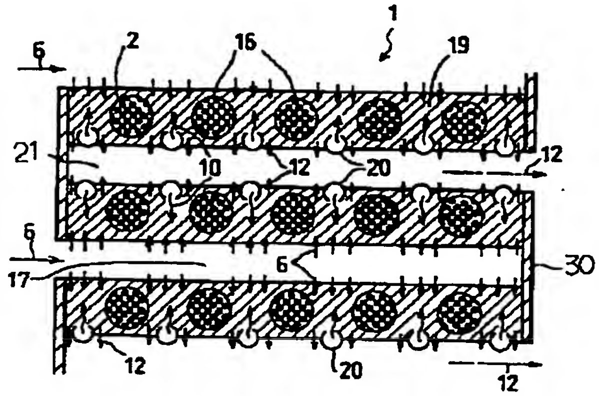

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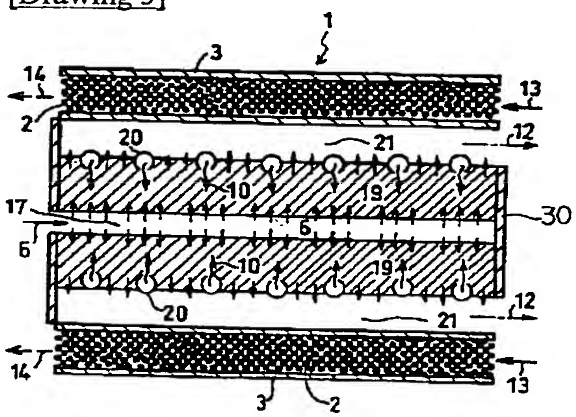

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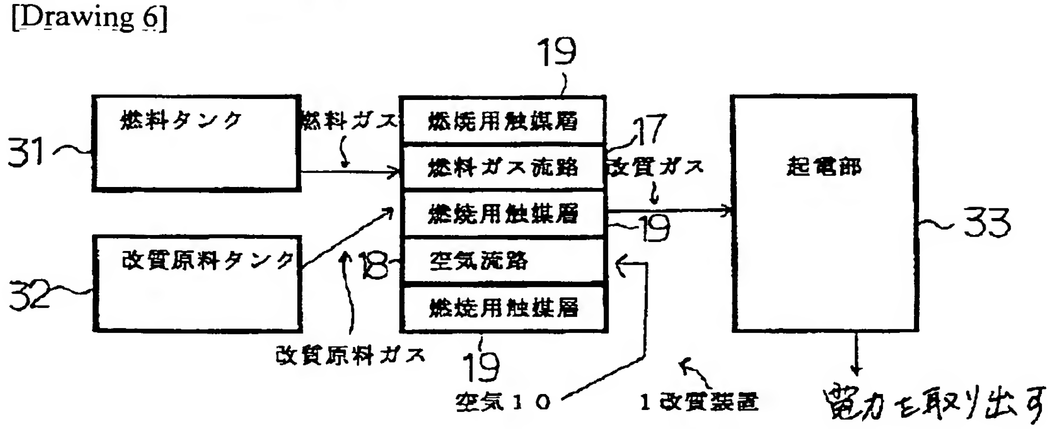
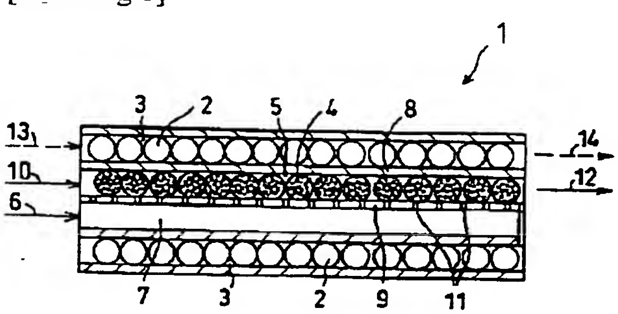


[Drawing 8]



[Translation done.]